Western Pearlshell Mussel (WEPE) Reproduction and Life History Study

The western pearlshell mussel (WEPE), *Margaritifera falcata* in Montana has experienced significant state-wide range reductions in the last 100 years and is now known from ~70 populations, of which, only ~20 are expected to be viable 100 years from now (Stagliano 2010 and 2015). The long-term declining status of the WEPE has led to its designation as the only Tier 1 invertebrate species listed in the State Wildlife Action Plan (MTFWP 2014), a Species of Concern by the State of Montana (MTNHP 2008) and a Sensitive Species by the U.S. Forest Service Region 1 (USFS 2011). Data on life-history characteristics (biotic) and habitat factors (abiotic) of viable and non-viable WEPE populations are needed to understand and address short and long-term environmental impacts. Determining the most important factors in sustaining viable WEPE populations will allow us to establish guidelines for suitable future actions towards recovering the state's numerous non-viable WEPE populations.

Research tasks accomplished during the grant period were directed at achieving 3 objectives:

1) Determining the reproductive status and timing of WEPE populations across 5 watersheds with varying stream temperature regimes and viability status (A-long-term viable to D-non-viable, declining populations). At all the watershed sites listed (**Table 1**), we completed multiple mussel checks of at least 20-30 individuals per visit to assess gravidity stages, and deployed zooplankton nets downstream of the beds to detect glochidia when a proportion of the population had released conglutinates (**Figure 1**). We used gonadal extraction techniques at a subset of the WEPE populations to further refine the timing of reproductive status (part of a MSU graduate study occurring concurrently). We continuously monitored stream temperatures within these stream basin sites through the reproductive phases and conglutinate release period.

Figure 1. Zooplankton Nets Sampling

2) Determining which host fish these WEPE populations are using by documenting the presence and timing of glochidia on salmonid gills. The hypothesis is that we will observe significantly higher rates of glochidial infection on native host fish at sites where WEPE populations are viable vs. declining populations. Secondarily, we are evaluating the host fish densities at the sites to determine if higher numbers of fish leads to higher glochidia infection rates. At all the watershed sites listed below, we completed fisheries surveys near the WEPE beds to assess native and non-native trout abundance and glochidia infection rates on their gills.

3) Determine the stream habitat conditions at each of the WEPE population sites with the hypothesis that we will observe significant differences in environmental conditions and stream habitat metrics at sites with stable (viable) WEPE populations compared to sites with declining non-viable WEPE populations. At all the watershed sites listed in **Table 1**, we completed qualitative and quantitative stream habitat measures to assess stream bed suitability.

Table 1. Pearlshell population viability of streams monitored during the 2019-2020 SWG study

Watershed	HUC	Stream	WEPE Viability	Data Logger
Big Hole	10020004	Clam Creek	A	x
		Deep Cr. (Upper)	B	x
		Deep Cr. (lower)	C	
		French Creek	C	x
		California	D	x
Upper Kootenai	17010101	Fivemile Creek	A	x
		East Fisher River	B	x
		Wolf (Upper)	C	x
		Wolf (Lower)	C	
		Pleasant Valley Fisher	D	x
Yaak	17010103	Yaak River (Lower)	A	x
		Yaak River (Upper)	C	x
		Vinal	X	x
Flint-Rock	17010202	Upper Willow Creek	A	x
		West Fork Rock (Lower)	B	x
		West Fork Rock (Upper)	B	
		Upper Willow (Lower)	C	
		Moose Meadows	C	x
		Sand Basin Creek	D	x
Blackfoot River	17010203	Clearwater River (Upper)	A	x
		Marshall Creek	B	x
		Clearwater River (Lower)	C	x
		Owl Creek	D	x
		Monture (FAS)	D	x
		Monture (H|H Ranch)	D	

Initial Observations and Results

1) Gravidity. We were successful at determining the reproductive status and timing of 25 WEPE populations across 5 watersheds with varying elevation, stream temperature regimes and viability status (A-long-term viable to D-non-viable, declining populations).

- Overall, warmer stream water temperatures and lower snowpack run-off in the Kootenai & Yaak watersheds in May to June triggered earlier pearlshell gravidity in those populations (by June 5th most populations were partially gravid), while in the Big Hole, June 10th was the date which most populations were highly gravid; higher elevation populations within the Rock-Flint watersheds had population gravidity of 50% into early July.
- In the Big Hole, gravidity of mussels paralleled population viability, with highest gravidity at A sites (peak of 90-100% fully gravid mussels checked), intermediate gravidity at B/C sites (peak of 33% fully gravid and 63 – 83% partially gravid mussels checked), and lowest gravidity at the D site (peak of 0% fully gravid and 10% partially gravid mussels checked).
- All population viability ranges (A-D) exhibited some gravidity across their individuals.
- We have not yet processed the paired zooplankton net samples taken at each site (**Figure 1**) for detecting glochida in the drift.

2) Fish Hosts. We've documented the presence and timing of glochidia on salmonid gills within many of the stream reaches of the WEPE populations for the 1st time in Montana. As we saw with gravidity, earliest host fish infections were documented in the warmer streams first (June 26th in the Kootenai watershed) and latest infected fish gills were observed in the Upper Rock Creek populations (July 27th).

- Non-viable WEPE populations (C & D) had fewer salmonids captured near the mussel beds, and lower percentages of these were infected with glochidia.
- We documented glochidia on all salmonid species captured, including non-native brook, rainbow (**Figure 2**) and brown trout (1st time field documented)
- In streams with native westslope cutthroat present (Upper Rock Creek) or Columbia Redband trout (Yaak Basin), WEPE glochidia infections were higher on these species compared to other non-native trout species captured in the same reach.
- A and B viable WEPE populations across multiple watersheds are maintaining reproductive capacity by solely using brook trout as their host fish.

Figure 2. Left-Rainbow trout from the Yaak River with a dense infection of WEPE glochidia (arrow points to a cluster) present on gills. Right-Gravid WEPE gills from the East Fisher River.

3) Habitat. We have not begun to evaluate the habitat data collected at the 25 WEPE stream sites to see how this correlates with WEPE viability.

Additionally, we hiked 3.5 miles into the upper Vinal Creek (Yaak) WEPE population (48.86801, -115.58304) to determine its viability; this site adds ~200 meters of an A-viable WEPE population to the number in the state (estimated number-3,200-5,000 individuals in population).